EXPANSION DISCHARGE SOURCE FOR ION BEAM LASER SPECTROSCOPY OF COLD MOLECULAR IONS

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Molecular ions are important in several fields of research, and spectroscopy acts as a key tool in the study of these ions. However, problems such as low ion abundance, ion-neutral confusion, and spectral congestion due to high internal temperatures can hinder effective spectroscopic studies. To circumvent these problems, we are developing a technique called Sensitive, Cooled, Resolved, Ion BEam Spectroscopy (SCRIBES). This ion beam spectrometer will feature a continuous supersonic expansion discharge source to produce cold molecular ions, electrostatic ion optics to focus the ions into an ion beam and bend the beam away from co-produced neutral molecules, an overlap region for cavity enhanced spectroscopy, and a time-of-flight mass spectrometer. When completed, SCRIBES will be an effective tool for the study of large, fluxional, and complex molecular ions that are difficult to study with other means. The ion beam spectrometer has been successfully implemented with a hot ion source.[a] This talk will focus on the work of integrating a supersonic expansion discharge source[b] into the instrument. To better understand how the source would work in the whole ion beam instrument, characterization studies are being performed with spectroscopy of HN_2^+ in a section of the system to ascertain the rotational temperature of the ion expansion. Attempts are also underway to measure the ion current from a beam formed from the expansion. Once the source in this environment is properly understood, we will reintegrate it to the rest of the ion beam system, completing SCRIBES.

[a] A. A. Mills, B. M. Siller, M. W. Porambo, M. Perera, H. Kreckel and B. J. McCall *J. Chem. Phys.*, **135**, 224201, (2011).
[b] K. N. Crabtree, C. A. Kauffman and B. J. McCall *Rev. Sci. Instrum.* **81**, 086103, (2010).